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ABSTRACT

Broadband technology has been introduced to the business community and the public as a fast and easy way of exploiting the Internet. The benefits of its use (fast reliable connections, always on) have been widely realised and broadband diffusion is one of the items at the top of the agenda for technology related polices of governments worldwide. Broadband diffusion and capacity development are central to debates in many countries concerning the role of the government in developing efficient broadband policies particularly in terms of the usage of public money. In this paper we examine the impact of government polices to broadband adoption in the case of the UK government, a country that is striving to have the most extensive and competitive broadband market in the G7 by 2005. We analyse specific institutional actions related to IT diffusion as pursued by the government with the view to identify best practices in government intervention. We believe that are our analysis is useful for broadband strategies in particular and technology in general when applied elsewhere.

Keywords: UK, Broadband, Diffusion

INTRODUCTION

Since the advent of the Internet, business opportunities involving Information and Communication Technologies (ICTs) have multiplied, persuading not only commercial enterprises, but governments around the globe to invest profoundly into e-services. However, now the potential of a clear link between the use of ICTs and economic growth are becoming apparent thereby urging numerous organisations and governments to invest profoundly into it (OECD, 2002). The e-services offered by governments are aimed at relaying information and public services to citizens over the Internet and is referred to in general as 'e-government'. E-government encompasses a broad spectrum of activities that are offered using ICTs and allows an improved service of the government to citizens (Northrup and Thorson, 2003). There are many varying definitions of e-government, but for the purposes of this paper, the following definition is offered. *E-government is the delivery of online government services, which provides the opportunity to increase citizen access to government, reduce government bureaucracy, increase citizen participation in democracy and enhance agency responsiveness to citizens needs* (Dempsey, 2001). The importance of this relationship between government and citizens has been recognised as crucial, such that, 30 European ministers recently agreed upon a plan to speed up the deployment of e-services as part of efforts to modernise the public sector EU-wide, at the second European e-government conference held in Italy in July 2003 (Cuddy, 2003). There is a growing trend of government intervention in IT innovation in general (King et al., 1994) and Internet exploitation in particular (Press *et al*., 1998). National interests in broadband clearly fall within this ICT policy trend.

The nature and definitions of broadband are varied and diverse causing confusion amongst industry, policy makers and academia. The umbrella term of broadband technology embraces a variety of high-speed access technologies including ADSL (Asymmetric Digital Subscriber Line), cable modems, satellite, and Wi-Fi (Wireless Fixed) Networks. The term

broadband has no established definition. It varies from country to country (Kelly, 2001) and evolves over time as the underlying transmission and routing technologies continuously advance: yesterday's broadband is today's 'narrowband'. There is no universally accepted definition of broadband and national definitions vary, but it is generally agreed that it applies to always-on services considerably faster than ISDN, typically more than 256 Kbps downstream access and 128 upsteam (OECD 2001). Definitions can be based on technical criteria, such as the capacity of the communication link, or on functional characteristics. Generally, broadband is a set of digital communication technologies with the capacity to transmit significant amounts of data at a high rate, supporting the delivery of a range of digital services, some or all of which can occur simultaneously.

Broadband diffusion and capacity development are central to the debates in many countries, principally surrounding the role of the government in developing broadband capacity; particularly focusing on the use of public money (e.g., BSG, 2004). Additionally there are exploratory studies on broadband that have identified the policy issue as pertinent in understanding its diffusion amongst the public. Specifically the web of stakeholders that can be influenced as in the case of South Korea (Choudrie, et al, 2003) or the mobile commerce opportunities arising from the use of broadband (Sawyer et al, 2003) are issues of interest.

The research question guiding this paper is: *What can be learnt about the role of government intervention for the future adoption of broadband technologies by examining some of the experiences of a country that is striving to have the most extensive and competitive broadband market in the G7 by 2005 (UK).* In line with that the aim of this paper is to extract the "success factors" in government intervention that support technology diffusion, based on the UK strategies in order to render favourable results if applied elsewhere.

The paper is structured as follows. First we give a brief overview of the UK broadband market, and emphasise the particularities of the country. In the third section we provide the theoretical framework upon which the results were based. Section four provides a description of the diffusion strategies of UK government strategies in terms of the normative model. Finally, based on our analysis, we offer some recommendations for government intervention in technology diffusion.

THE UK BROADBAND MARKET

In the United Kingdom the government is targeting to have the most extensive and competitive broadband market in the G7 by 2005 (Arnott, 2003). The UK government predicts that broadband services offering higher connectivity and entirely new sorts of value added services will be a significant factor in determining national competitiveness over the coming years (BSG, 2004). By obtaining such a position, the government intends to achieve tremendous improvements to the economy via increased spending in the technology and telecommunications sectors. The efforts have been fruitful so far as to date, there are 3 million users of broadband within the UK and 32,000 new users per week are being signed on (Ofcom, 2003). The competition in technology in the UK is mainly between ADSL (Asynchronous Data Subscriber Line) and cable modem users with 1.6 million subscribed to ADSL and 1.3 to cable modem services at the end of August 2003 (Oftel, 2003).

In terms of infrastructure development for broadband, in the UK the availability of ADSL services covers 80% of UK homes and business, while availability of cable modems is present within 45% of homes and business (Oftel, 2003). The UK housing patterns are scattered, making infrastructure building difficult. With 80% of the UK population living in cities and towns and a housing population of over 10,000 people, but with a cover of some 7% of the land, thereby making connections between the ISPs exchanges and residential consumers difficult . Over 40% of the population live in London, the conurbations and the larger cities. Each of those major urban areas has a potentially wide influence. London is the second most densely populated region in Europe with the housing patterns being as follows. 81% are houses; 50% are detached or semi-detached houses (ODPM, 2001). Recent figures suggest that broadband availability is highest in urban and suburban areas since the economies of density make it much more cost effective for its spread (BSG, 2004).

According to Ofcom the Office of comminations responsible for the telecommunications regulation in the country, there is vivid competition at the infrastructure level between cable modem and DSL providers and numerous service providers competing to provide retail DSL services pushing the prices down. For the residential broadband services the prices in the UK are (when cable modems are excluded) similar to France and cheaper than all other EU countries. France is at

approximately £22 and the UK at £23 (DSL is at a minimum bandwidth requirement of 257 kbps downstream (Ofcom, 2003). Nevertheless, the UK government's vision for a competitive broadband market does not comply with the current image of the country in relation to competitive markets within the European Union and OECD. More specifically in June 2003 broadband penetration per 100 people in the UK (4%) was lower than EU (5%) and OECD (6%) averages with other north European countries such as Denmark and Belgium reaching 15% in June 2003 (OECD 2003). The membership of UK in the OECD gives the policy makers in the country another incentive to diffuse broadband to the public as the OECD recently (12/02/2004) called on governments to do more to encourage the development of broadband emphasising its importance for economic, social and cultural development and warning about the risk of missed opportunities from failing to do so. The OECD believes that without comprehensive action there is a danger that some countries could miss out on new market opportunities and growth through innovation and productivity increases (OECD 2004). Additionally, the EC regulatory framework requires member states to review the main electronic communications markets (including broadband) by July 2003 in order to insure that regulation remains proportionate in the light of changing market conditions (Oftel, 2003).

Overall, the broadband adoption in the UK is relatively low today, but the projections for the future are positive as both the government initiatives and the active engagement of the private sector in a competitive marketplace are indicators of a healthy market with potential future development. In the next section we present the theoretical framework that is based upon the analysis of the UK government broadband strategies.

BROADBAND DIFFUSION: THE ROLE OF THE GOVERNMENTS

The issue of government's influence on technical innovation dates back to the nineteenth century, where the administration intervention was in contrast with the general *laissez-faire* economic philosophy. Later governments began to get more involved in the field and today there is no doubt that the government market has an important influence on industrial innovation (Rothwell and Zegveld, 1981).

Japan was the first country where in the 1960s, the government had the main responsibility to encourage the introduction of new technologies and design a long-term technology policy (Freeman, 1998). Later (mainly in the 1970s and 1980s), the governments in Western Europe and North America worked along the same patterns in government intervention but following different conceptions of competitive advantage. Finally in the 1990s, there was an agreement in the literature about the vital role of public administration in the diffusion of new technologies (e.g. (Neo *et al.*, 1993; King *et al.*, 1994; Neo *et al.*, 1995; Rapp, 1996)).

In the case of Internet technologies such as broadband, although there is a tendency to move from *localisation* to *globalisation*, national governments still play a very important role in the design of strategies reflecting to a vision towards National Information Infrastructure (NII) (see (DTI, 1998; The White House, 1999; Ministry of Information and Communication (MIC), 2002)).

Viewing broadband technology as a technological innovation that has the potential to revolutionise the use of the Internet by small companies and individuals, in this section we describe strategies and measures commonly used by national governments in the diffusion of such technologies. For instance, we examine how the South Korean government acted as a powerful entity that applied these strategies and hastened the adoption of broadband in the society. The relevant UK strategies are also presented for our analysis.

The framework selected for this research is that proposed by King et al (1994). The researchers have used the demand-pull and supply push theory in government intervention for technology diffusion. They argue that governments can either be influential or regulatory. Combining the two modes of introversion with the two types of driving forces six main institutional actions are defined. These are knowledge building, knowledge deployment, subsidy, mobilisation, innovation directive and standard setting are presented in Figure 1.

	SUPPLY PUSH	DEMAND PULL
INFLUENTIAL	Knowledge building Knowledge deployment Subsidy Innovation directive I	Knowledge deployment Subsidy Mobilization II
REGULATORY	III Knowledge deployment Subsidy Standard setting Innovation directive	IV Subsidy Standards setting Innovation directive

Figure 1. Dimensions of Institutional Intervention (Source: King, et al., 1994)

Using the above framework we examine how the Korean and the UK governments have used certain policy measures in order to diffuse the broadband technology.

ANALYSING THE UK BROADBAND STRATEGIES

The strategy of *knowledge building* refers to financial support for research and development (R&D) which typically takes place in universities and other research centres.

The UK government is looking to extending the broadband infrastructure development by examining other types of connections apart from DSL and cable modems (Oftel, 2003). Technologies such as bypass optical fibre, broadband fixed wireless access (BFWA), community wireless networks, Wi-Fi hot spots and satellite are options that are considered through research taking place with BT (the incumbent monopolist) and the cooperation of other suppliers in trials such as the Remote Broadband Inclusion Trial.

Knowledge deployment is the diffusion of new knowledge to individuals and organisations such that they are able to use the new emerging technology correspondingly. Entities that can be supported for this action from the administration are research institutes in university or industrial environments.

The UK government has lately recognised the importance of deployment of technology and has begun to provide funding for education on ICT. This has been implemented by government departments such as the Department of Further Education and Skills (DfES) which is spending GBP 79 million from the Standards Fund to provide schools in England with broadband access to the Internet. The fund is allocated to a number of regional broadband consortia. Additionally, the government invested £3 million in the education and training of private organisations in programmes known as e-skills UK. This has become one of the first of 23 sector skills councils being created to give employers a direct input to government training policy and the development of courses in schools, colleges and universities (Goodwin, 2002). To prevent only a focus upon the youth, the government is also promoting use of computers amongst the older generations by having buses travelling around the country and introducing this group of the society to the benefits of this technology (Cushing, 2002). Additionally the government has opened approximately 600 training centres that are located within easy access of the citizens. Therefore, diverse local community centres, shopping centres, pubs, football clubs and funfairs are providing training and knowledge about IT (Lynch, 2000).

Subsidy can be direct, with financial support to all actors involved in the technical innovation, or indirect, with support for infrastructure building and establishment of favourable charging mechanisms for network services. In the technologically advanced countries today subsidy has moved from the traditional direct financial companies' support to more complex schemes. For example, private subsidy, mainly through venture capital companies, has been broadly used by governments as a way to fill the funding gaps of private financial support schemes (OECD, 1997).

Unlike other strategies such as those pursued by the South Korea, Sweden, USA and France governments that have spent large amounts funding infrastructure development for broadband to the rural areas, the UK government supports a different view. It favours a market-led approach in conjunction with a drive towards aggregating the public sector demand for broadband (Wearden, 2002). Subsides are injected indirectly by public/private sector initiatives such as the one developed by Coventry University which will fund more than GBP 7 million to small and medium size businesses (SMEs) in Coventry and Warwickshire in order to make them more competitive by exploiting broadband networking. Similarly, Pows County Council together with the Welsh Development Agency (WDA) established a project that encourages the public and private sectors to form partnerships in order to upgrade the broadband network in rural Wales for supporting ADSL.

Mobilisation expresses the intention of the government to make organisations/individuals to perceive the innovation, the potential benefit of the innovation in the 'right' way and understand the best practice for adopting it and encouraging them to do so.

There is no such action that is undertaken within the UK. However, communities, focus groups and the media have been working hard to describe the potential of this technology. In the UK, for example, the focus group Broadband Stakeholder Group in its first annual report recommended a strategy for accelerating the broadband penetration which included 15 strategic recommendations in three areas: accelerating market driven deployment and take-up, enabling public sector driven deployment and use, and ensuring appropriate regulation (BSG, 2002). While 14 out of 15 recommendations were accepted by the government, one recommendation on fiscal policy for tax incentives to boost the broadband infrastructure was refused (Adshead, 2001). This caused a campaign called 'Broadband Britain?' to occur from the industry to urge the government to act in order to meet its pledge for the most competitive broadband market to be formed by 2005 (Arnott, 2001).

*Innovation directive*s are norms that regulate the production or use of innovation in the governmental regime in order to set an example for companies and individuals that tend to use the technology.

The UK government similar to most current governments is making substantial investments to the e-government initiatives. During 2000 the Prime Minister pledged £1 billion to e-government initiatives and as a result an electronic service has been established for organisations interested in investing in the UK and to provide information and services, such as training how to conduct e-business in other countries, to learn of the new cultures and the way that they conduct business, and financial assistance can also be provided by qualifying for specific awards. Such measures should allow British organisations determined or already established in foreign shores to make a mark in the international markets (British Trade International e-business Programme, 2002). Citizens are also being catered for. For instance, parents can obtain online information about schools within the country and the pension bearing citizens can find out about their pensions and receive payments electronically (Lynch, 2000). Additionally, the National Health Service (NHS) is committed to provide all hospitals and the majority of general practitioners with broadband connections. The government is also committed to provide all public libraries in the UK with broadband connections. In terms of the success of the e-government projects, the UK was viewed to be eighth amongst twenty two countries for its e-government initiatives (Lynch, 2001).

Standard setting refers to the formalisation of practices and limitation of options for organisations participating in the technology innovation.

The UK government has lately realised the importance of standards setting and is now in the legislator planning stages towards the building industry with the view to offer broadband infrastructure to households such cable and wireless connections (Wearden, 2003). Additionally, Oftel the regulatory body in the UK has been working towards redefining broadband as there are Internet Service Providers (ISPs) attempting to confuse consumers, and they are also looking at the establishment of fair market prices (Ritchardson, 2003).

After the analysis of the policy measures pursued by the UK government, in the next section we draw some conclusions and offer some recommendations related to government intervention in supporting technology diffusion.

POLICY IMPLICATIONS-CONCLUSIONS

In the UK, the government established a clear goal for broadband by stating that the technology will allow the country to become an e-commerce leader within the G7. The strategy of the government is the provision of leadership on broadband by setting the goal as well as creating a strategic partnership with key players in the private and public sectors, and continues to drive forward competition in the supply of infrastructure and services.

Thus, according to our analysis the policies pursued by the government are mostly influential with an emphasis on the supply push (represented by I in Figure 3), leaving the competition to lead the market. Today, as the government's goal seems to remain unapproachable with broadband take-up being relatively low the government is looking at developing educational programs enforcing the demand pull while looking at regulating the vendors market. The results of these efforts are encouraging as there are an increased number of subscribers (explained earlier in the paper) and positive projections for the future. Figure 2 presents the UK government's strategy development, where there is a move from influential, supply push strategies to more aggressive polices towards regulation development and demand pull.

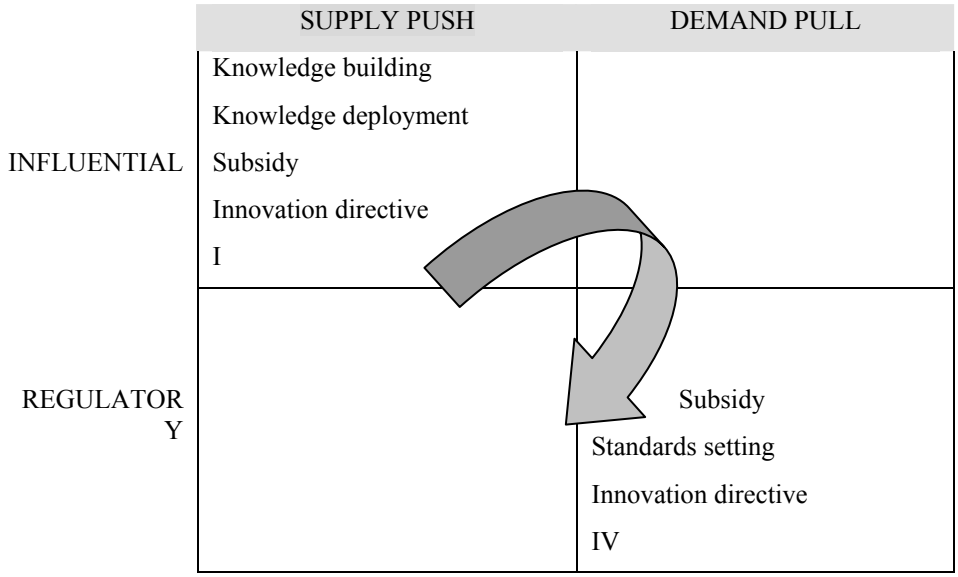

Figure 2: The UK broadband strategy

Our analysis demonstrated that the principles of UK broadband diffusion strategy that pursues a pro-market policy is far from the traditional interventionist government such as the one followed in South Korea for example, a country that is by far the leader in broadband adoption (Choudrie et. al., 2003). Given the tendency in the UK, BT's action to aggressively promote broadband in 2002 cannot be attributed directly to the government influence. At the same time, however, it cannot be denied that the government's push for the ambitious goal of being a broadband leader in Europe did not affect the incumbent

operator's action. In addition, a variety of measures implemented by the government contributed to changing the broadband environment, while according to our analysis there is a tendency of the UK government to start being more interventionist in its approach to broadband diffusion.

Although each national setting is different in terms of culture, geography and social structure we believe that successful or less successful IT diffusion strategies can be useful lessons for policy makers seeking to promote broadband, which in turn can assist in obtaining e-government services in the future.

Future directions for this research include examining the attributes of broadband (Rogers, 2003) as an innovation that has the potential to impact a citizen's use of Information technology, the Internet in particular. Additionally the examination of the digital divide between countries and within countries (Papazafeiropoulou and Pouloudi, 2003) in terms of broadband adoption will be areas for future research.

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